

Claims

1 ~~SUB~~ 1. A golf club shaft formed by winding a plurality of layers around a
2 ~~AS~~ mandrel that is removed after curing comprising:
3 a layer of metal-containing prepreg wrapped at a tip of the shaft;
4 and
5 a layer of non-metal fiber prepreg wrapped adjacent to the layer of
6 metal-containing prepreg throughout a length of the shaft.

1 ~~SUB~~ 2. The golf club shaft of Claim 1 wherein the layer of
2 ~~AS~~ metal-containing prepreg wrapped at the tip of the shaft comprises a first layer of
3 metal-containing prepreg and a second layer of metal-containing prepreg

4 3. The golf club shaft of Claim 1 wherein the golf club shaft has a
5 mass of about 80 - 130 g.

6 4. The golf club shaft of Claim 1 wherein the golf club shaft has a
7 center of mass located at about 45~51% when measured from the tip and
8 expressed as a ratio to an overall length of the golf club shaft.

9 ~~SUB~~ 5. The golf club shaft of Claim 1 wherein the gold club shaft has an
10 ~~AS~~ elasticity index (E) value about $3.0 \sim 4.5 \text{ kgf} \cdot \text{m}^2$ at 200 mm from the tip.

11 ~~SUB~~ 6. The golf club shaft of Claim 1 wherein the layer of
12 ~~AS~~ metal-containing prepreg located at the tip of the shaft is an inner-most layer.

13 ~~Sub B1~~ 7. The golf club shaft of Claim 6 wherein the inner-most layer of
14 metal-containing prepreg is located along a length of the shaft between a tip of
15 the shaft and 40% of an overall length of the shaft.

16 ~~Sub A4~~ 8. The golf club shaft of Claim 6 wherein the layer of non-metal
17 fiber prepreg is wrapper over the inner-most layer of metal-containing prepreg.

18 ~~Sub B~~ 9. The golf club shaft of Claim 1 wherein the layer of
19 metal-containing prepreg comprises a metal having a specific mass greater than
20 7 g/cm³.

21 10. The golf club shaft of Claim 1 wherein the layer of
22 metal-containing prepreg contains a metal fiber.

23 11. The golf club shaft of Claim 1 wherein the layer of
24 metal-containing prepreg contains a metal powder.

25 12. The golf club shaft of Claim 11 wherein the metal powder is
26 dispersed in a synthetic resin sheet.

27 13. The golf club shaft of Claim 12 wherein the metal powder
28 comprises tungsten.

29 ~~Sub A5~~ 14. The golf club shaft of Claim 12 wherein the synthetic resin
30 sheet comprises epoxy resin.

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31 15. A method of making a golf club shaft comprising the steps of:
32 providing a mandrel that tapers from a butt end to a tip end;
33 wrapping a layer of metal-containing prepreg around the mandrel
34 from the tip end thereof toward and toward but not all the
35 way to the butt end thereof;
36 wrapping a layer of non-metal fiber prepreg adjacent to the layer of
37 metal-containing prepreg from the tip end thereof all the way
38 to the butt end thereof;
39 curing the prepreg; and
40 removing the mandrel from the prepreg.

41 16. The method of making a golf club shaft of Claim 1 wherein the
42 mandrel has a nonlinear taper along its length that creates an annular recess at
43 the tip end thereof and wherein the step of wrapping a layer of metal-containing
44 prepreg around the mandrel from the end thereof toward but not all the way to
45 the butt end thereof is accomplished by wrapping the layer of metal-containing
46 prepreg around the mandrel along the annular recess.

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